Transforming Key African Farming Systems through Sustainable Intensification

Can Sustainable Agricultural Intensification Feed the World?

USDA Ag Outlook Forum

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Too little:

Food and Agriculture Organization (2010)

Over 1 billion people classified as ‘urgently hungry.’

Too much:

Millennium Ecosystem Assessment (2005)

"…largest threat to biodiversity and ecosystem function of any single human activity."

Green Revolution =
Improved seeds + inputs + water

Most successful with good soils, abundant water

Failed to address some social and environmental issues

Africa:

- >80% soils with serious limitations
- 95% rainfed
- High variability
- Low input investment

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Africa Research In Sustainable Intensification for the Next Generation

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Research for development of TRANSFORMING options for small-holder farmers

- Meet multiple needs at multiple scales (includes social, economic, nutrition, gender, natural resource management issues)
- Go beyond trade-offs
- Adaptable & adoptable

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KEY FARMING SYSTEMS in 3 regions

- High poverty
- High population
- Medium – high agriculture potential

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SUSTAINABLE INTENSIFICATION

- While increasing productivity and/or reducing risk:
- Utilize ecological processes (e.g., biological N fixation, natural predators)
- Minimize environmental hazards
- Maintain soil & water quality
- Use modern & traditional strategies
- Acknowledge local environmental & cultural conditions

(Pretty et al. 2011)

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Illustrative examples:

- ‘Push-pull’ management of pests and weeds
- Evergreen Agriculture
- Doubled-up maize-legume systems

(Pretty et al. 2011)

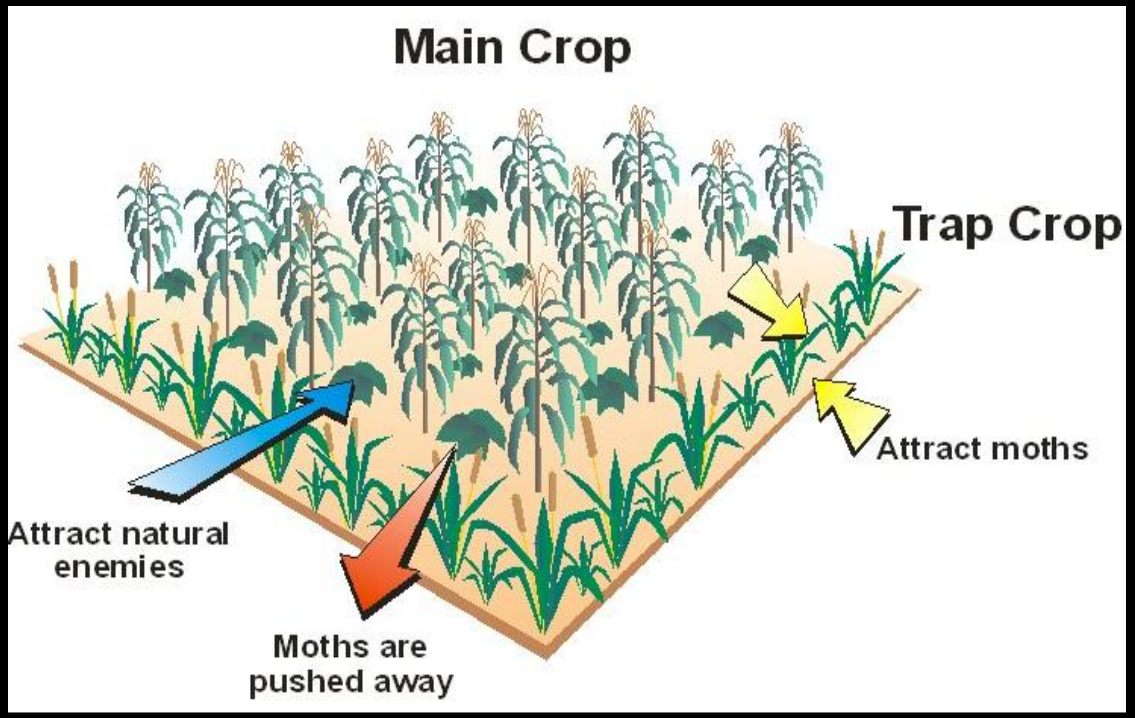
‘Push-pull’ management of stem-borers and *Striga* weeds

Desmodium:

- N-fixing perennial
- Intercropped with maize
- “Pushes” *Striga* and stemborer moths
- “Pulls” natural enemies

Napier grass:

- Perennial forage crop
- Planted around field
- “Pulls” stemborer females

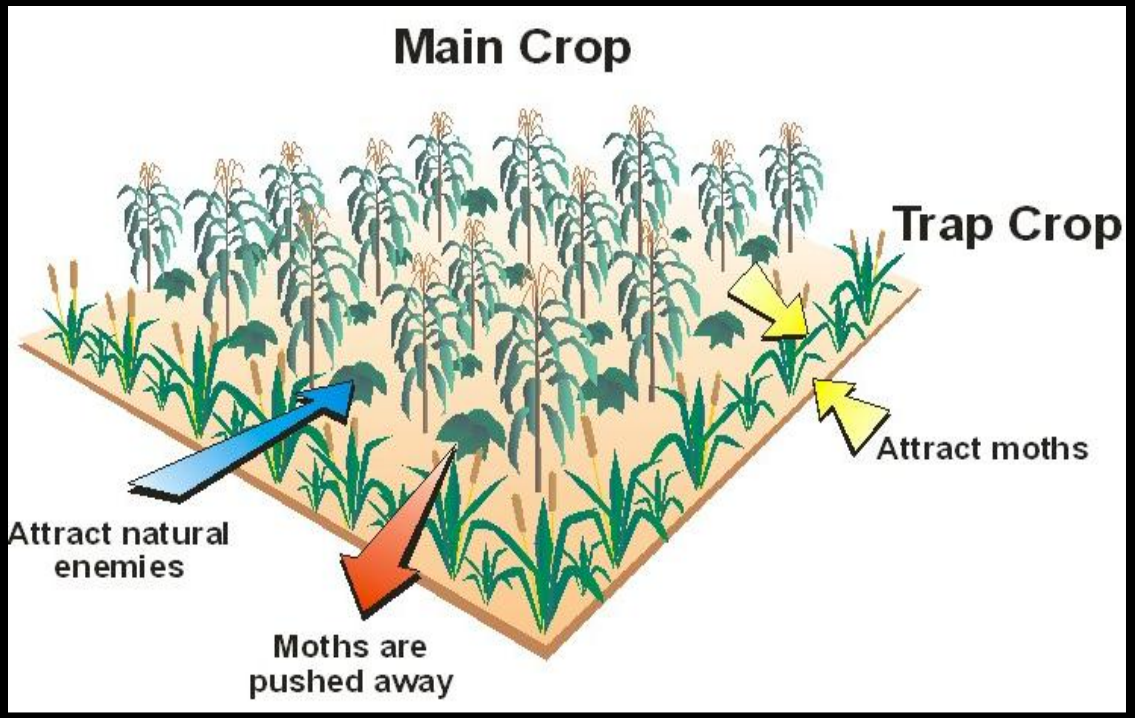


(Khan et al. 2010)

‘Push-pull’ management of stem-borers and *Striga* weeds

Benefits

- 3.5X greater maize yields
- Locally available crops
- Reduced external inputs
- Increased livestock forage production
- Improved soil fertility & moisture retention
- Adopted on 30,000 farms



(Khan et al. 2010)

Evergreen Agriculture

- Intercropping of trees in annual crop fields
- Low investment costs
- Often use N-fixing trees
- Complementary growing seasons & resource use

(Garrity et al. 2010)

Evergreen Agriculture

Benefits

- 4X greater maize yields
- Better yields in high & low rainfall years
- Enables farm investment
- Increased fuel & forage production
- Improved soil fertility & moisture retention
- Adopted on >5 m ha

(Garrity et al. 2010)

Doubled-up Maize/Legume Systems

- Yr 1: Intercrop soybean & shrubby pigeonpea
- Yr 2: Pigeonpea regrows in planted maize

(Snapp et al. 2010)

Doubled-up Maize/Legume Systems

Benefits

- Same maize yields with ½ the fertilizer
- 50% greater protein yield
- Permanent soil cover
- Decreased risk, labor requirements
- Livestock fodder production
- >8,000 adopters in Malawi

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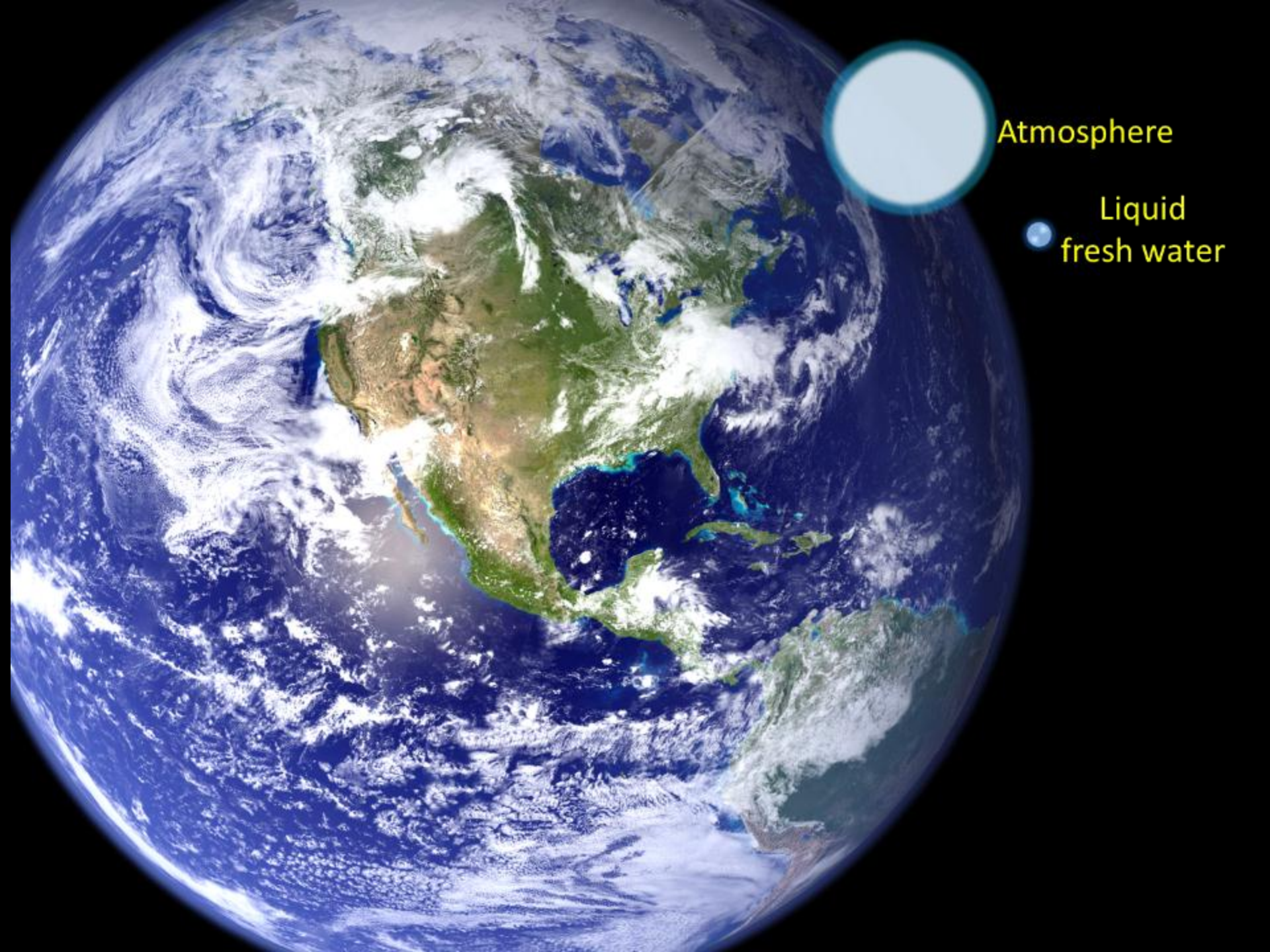
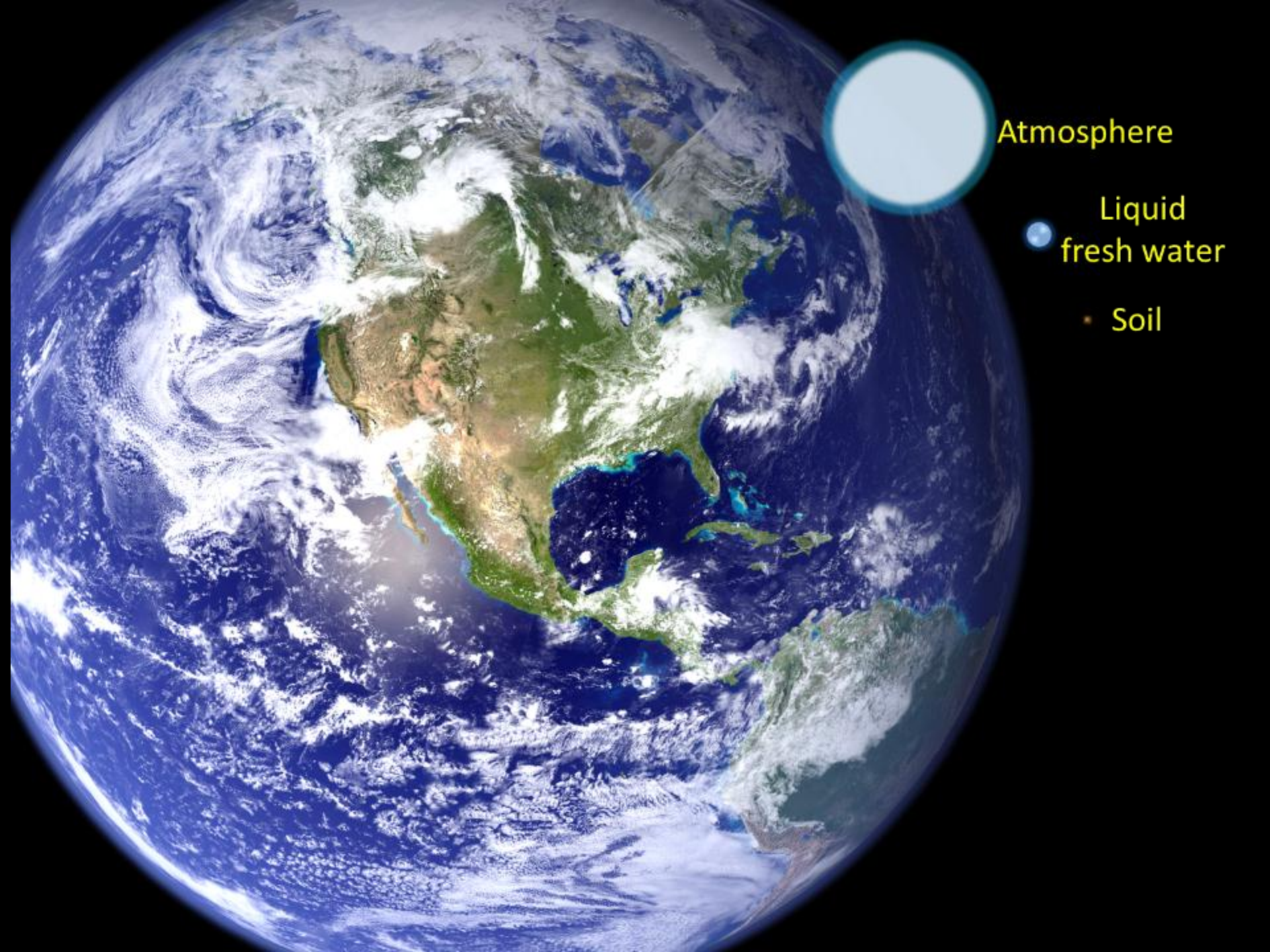
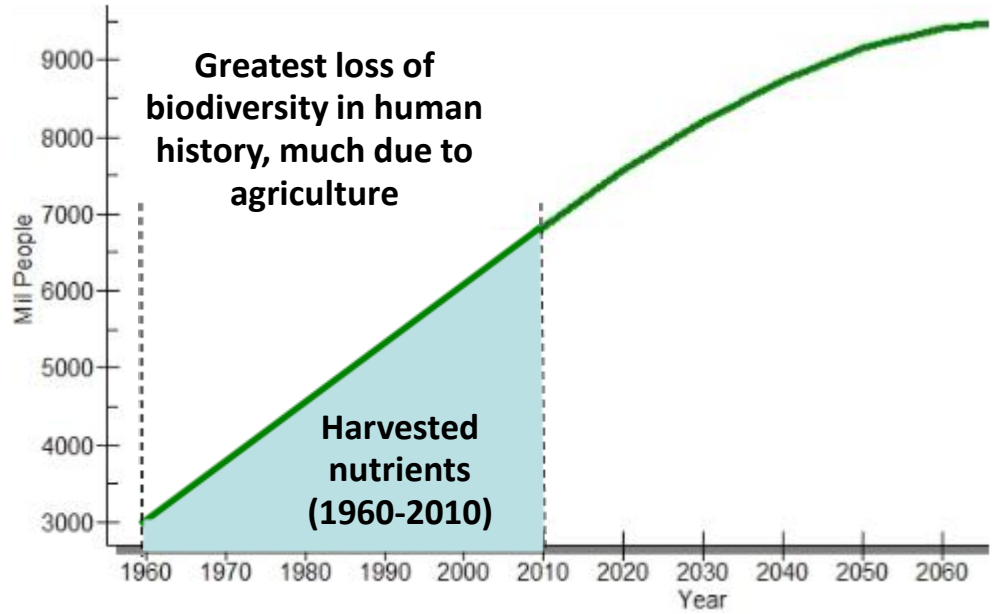

Atmosphere
Liquid
fresh water


Atmosphere
Liquid
fresh water
Soil

Atmosphere

Liquid fresh water

Soil



Atmosphere

Liquid fresh water

Soil